REMARKS/ARGUMENTS

Favorable consideration of this application is respectfully requested. Applicant has amended the title so that it is descriptive of the claimed invention, amended the specification by voluntarily updating the status of the parent application and revising the current abstract to more accurately describe the claimed invention while limiting the description to 150 words or less. Claims 37-40 are now pending. Claims 41-43 are cancelled because of a restriction requirement. No new matter has been entered. Favorable reconsideration is earnestly solicited in view of the following remarks.

In paragraphs 1 – 4 of the Office Action of May 01, 2006, the Examiner argues in support of the Restriction requirement based on finding two distinct inventions: I- Claims 37-40, drawn to an "octopus"-like, multi-fiber carbon structure and II- Claims 41-43, drawn to a method of producing a single-fiber, carbon nanotube. [Underlining added for emphasis.]

The above restriction requirement was discussed with Applicant's attorney on April 13, 2006; Applicant has elected to prosecute the invention of Group I, claims 37-40, with traverse. This election was made with traverse and Applicant reserves the right to file a divisional application for the non-elected invention in Group II, Claims 41-43.

Referring now to each of the Examiner's objections beginning on page 3, paragraph 5, of the Office Action of May 01, 2006, Applicant addresses each objection in the numerical sequence of each paragraph in the Office Action.

In paragraph 5, the Examiner states that "[t]he information disclosure statement filed 7/18/03 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because a clean 1449 must be submitted." Applicant submits herewith a clean PTO-1449 form listing all prior art references known at the time of filing. Accordingly, Applicant respectfully requests the

withdrawal of the Examiner's objection to the information disclosure statement for failure to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 and consider the information referred to therein as to the merits.

In reply to the Examiner's objection to the specification in paragraph 6, the language of the Abstract of the disclosure has been reworded to include a description of the current invention to which the claims are directed. Support for the revised Abstract is found in the original Abstract, in the specification at page 19, lines 4-7 and 15-18; page 20, lines 13-22, and original claim 38. No new matter is added by the revision; accordingly, Applicant respectfully requests the withdrawal of Examiner's objection to the Abstract.

In paragraph 7 of the Office Action of May 01, 2006, the Examiner objects to the title of the invention as not being descriptive of the invention to which the claims are directed. Applicant has amended the title to read: PORTABLE HYDROGEN GENERATOR FUEL CELL APPARATUS AND PROCESS FOR PRODUCTION OF FILAMENTOUS CARBON PRODUCTS. The amendment to the title is underlined. Accordingly, it is respectfully requested that the new title be entered and this objection be withdrawn.

Referring now to the Examiner's rejection of Claims 37-40 in paragraphs 8-10 of the Office Action of May 01, 2006, Applicant has amended the claims to specifically claim the inventive features and thereby distinguish the present invention from each of the references cited by the Examiner. No reference cited teaches or suggests that heating or sending an electric charge through a carbon-based catalyst in the presence of hydrocarbon fuels would not only produce hydrogen gas, but would also produce novel hydrophobic, filamentous carbon products that are at least one to two orders of magnitude thicker than conventionally produced carbon nanofibers.

A succinct statement of Applicant's invention is: Novel filamentous carbon products are produced during the thermocatalytic decomposition of hydrocarbons that are hydrophobic and of a size which is one to two orders of magnitude thicker than conventionally produced carbon fibers and form an "octopus"-like structure permitting use as a hydrophobic "sponge" that readily adsorbs oil and, are thus, useful for the clean-up of oil spills on the surface of water. [*Underlining added to identify the inventive concepts.*]

Claim 37 is now amended, in the preamble, to enhance the description of how the carbon particles are formed. Support for this amendment is found on page 19, lines 4-7 and 15-18. Claim 37 is further amended to amplify the description of the thickness of the carbon particles and distinguish the thickness from the cited references. Support for this amendment is found in the specification on page 19, lines 17-18. Claim 37 is also amended to identify the hydrophobic nature of the filamentous carbon particles; support for this amendment is found on page 20, lines 15-16.

In Claim 39 the archaic term "said" is replaced with the term "the." This amendment adds no new matter; and it updates the language of the claims.

No new matter has been added by the amendments to Claims 37-40. Applicant's invention is now set forth in claims that are clearly distinguishable from any references cited by the Examiner.

Claim Rejections under 35 USC §102(e) or in the alternative, under 35 USC §103(a):

Claims 37-38 are rejected under 35 U.S.C. 102(e) as being anticipated by or, in the alternative, under 35 U.S.C 103(a) as obvious over Nishimura et al. in U.S. Pat. 6,103,373 (paragraph 8 of the Office Action of May 01, 2006). The Examiner argues that Nishimura teaches carbon particles having an "octopus"-like structure (Figure 2 & Column 4) made up of carbon

fibers having diameters of 0.1 – 5 microns, preferably 0.1-1, bonded to a carbon center. The carbon filaments of Applicant's invention are completely different than the carbon particles of Nishimura. First and foremost, Nishimura does NOT produce carbon particles having and "octopus"-like structure as alleged by the Examiner; Nishimura uses "shear or compressive forces to produce fiber agglomerates having agglomerate sizes ranging from not less than 5 μm and not more than 500 μm." See Nishimura at column 4, lines 47-50. There is no suggestion or teaching that "octopus"-like structures could be formed in a process for the decomposition of hydrocarbons, as disclosed by Applicant. Applicant's network of fibers is formed without press-forming.

Further distinctions between Nishimura's patent and Applicant's invention are the processes for forming the carbon filaments. The Examiner admits that the fibers are grown by chemical vapor deposition (CVD). In particular, Nishimura refers to vapor grown carbon filaments (VGCF) produced by a number of methods that involve seed crystals of transition metals, e.g., iron (Fe). It should be noted that these metal particles remain in VGCF after the process and require a complex and expensive post-production treatment to remove the metal particles from the carbon product. In contrast, Applicant does not use chemical vapor deposition to form carbon fibers, nor does Applicant require the presence of metal catalysts and, therefore, there is no need for the after-treatment of the carbonaceous product, which significantly simplifies the process.

A further distinction between Nishimura's teachings and Applicant's invention is shown in claim 38. The carbon fibers of Applicant's invention have oil film absorption properties not only because their surface is hydrophobic, but also due to their sponge-like structure that readily and selectively absorbs oily liquids for water. In contrast, Nishimura' agglomerates are dense compressed structures that lack the sponge-like structure and effect.

Finally, the Examiner's argument that the graphitic structure of Applicant's fibers is imputed to Nashimura fibers by Nashimura's teaching that the fibers have excellent conductivity; this argument does not support the broader argument that Nashimura's teachings are sufficient to anticipate or make obvious Applicant's invention. That is tantamount to saying that anyone who produces fibers having a graphitic structure with excellent conductivity anticipates Applicant's invention. The Nishimura patent discloses a very different invention than Applicant's, and by amendments to the claims, Applicant has clearly distinguished the present invention from Nishimura. Applicant respectfully requests the withdrawal of the rejections of Claims 37 and 38 under 35 U.S.C. 102(c) as being anticipated by or, in the alternative, under 35 U.S.C 103(a) as obvious over Nishimura et al. in U.S. Pat. 6,103,373.

In paragraph 9 of the Office Action of May 01, 2006, Claims 37-38 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Egashira et al. et al. (*Carbon* 1983). The Examiner argues that Egashira et al. teaches carbon particles made up of multiple hollow graphitic carbon fibers of uniform length and diameters of 1-10 microns that are attached to a carbon bead. However, the Examiner overlooks the substantial differences between the carbon filaments of the present invention and those disclosed by Egashira et al.. In particular, Egashira et al.'s carbon fibers are formed on the surface of sulfur-containing carbon beads produced from sulfonated polymers with sulfur content of 1.1 – 3.3 wt. %. Further teachings by Egashira et al. on page 89 (sentence bridging the left and right column of text) are "This sulfur-containing hard carbon, in the form of spherical beads, seems to be one of the most promising substrates for the preparation of sea urchin-type particles, *since growth of carbon fibers is catalyzed simply by sulfur itself.*" [Underlining and italics added for emphasis.]

It is appropriate to discuss the difference in "sea-urchin" type particles and "octopus" like structures, because this also distinguishes Applicant's invention from Egashira et al. et al. Sea-urchin type particles are by definition of a different structure than "octopus"-like structures. Sea-urchins are usually round compact structures that are in solid clumps; whereas, an "octopus"-like structure has a clump surrounded by a tangled arrangement of tentacles. The "octopus"-like structure supports Applicant's use of the novel particles as a hydrophobic sponge to adsorb oil from the surface of water; the more solid clump arrangement of a sea-urchin particle is an unlikely candidate for sponge-like qualities. A further distinction is discussed below.

In contrast to Egashira et al. et al., Applicant's process is sulfur-free and does not require the presence of sulfonated groups to produce carbon fibers. Applicant requires the use of "a sulfur-capturing dopant" when a sulfur-containing fuel is used (see page 13, lines 7-17; page 15, lines 25-26) to remove the possible sulfur contamination of Applicant's filamentous carbon fibers. The presence of sulfur in filamentous carbon structures may not be desirable in many application areas, such as, batteries, composites, and the like.

With regard to the rejection of Claim 38 as anticipated by or obvious in view of Egashira et al., the presence of sulfonic groups will render the fibers hydrophilic rather than hydrophobic, as alleged by the Examiner. Thus, the sulfur-containing carbon structures of Egashira et al. et al. are unlikely to be good absorbers of oil films on water.

Applicant has pointed out substantial differences between the teachings of Egashira et al. regarding *sulfur-containing*, *hydrophilic* carbon fibers and the sulfur-free, hydrophobic carbon fibers discovered by Applicant; accordingly, Applicant respectfully requests the withdrawal of the rejections of Claims 37 and 38 under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C 103(a) as obvious over Egashira et al. et al. (*Carbon* 1983).

In paragraph 10 of the Office Action of May 01, 2006, Claims 39-40 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Murata et al. (U.S.Pat 5,650,132) in view of Lee (U.S. Pat 4,292,505), Chung (U.S. Pat 5,643,670), and Egashira et al. et al. (*Carbon* 1983).

The Examiner has essentially used Applicant's invention as the basis for citing and combining four references to reject Applicant's invention under U.S.C. 103(a). It will be pointed out below that each of the cited references is significantly different than Applicant's invention and the combination of such references is impermissible under well established case law, to defeat the patentability of the invention being examined. In *In re Rouffet*, 47 USPQ 2d 1453, at 1457-1458 (Fed. Cir. 1998), the Court said "[t]o prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." No motivation for the combination of these references has been shown absent Applicant's invention.

It was not known, suggested, taught or disclosed in any reference cited by the Examiner that hydrophobic, "octopus"-like carbon fibers with longitudinal uniformity would be formed when sending an electric charge through a carbon-based catalyst in the presence of hydrocarbon fuel to produce the novel carbon products claimed by Applicants.

Murata is cited for teaching a process for thermocatalytic decomposition of hydrocarbon with a carbon-based catalytic material, but does not collect any carbon products. Lee is cited for teaching a furnace heated by electrical resistance that uses silica and carbonaceous particles as resistors to heat the furnace, but does not produce any filamentous carbon products. Chung is

cited for teaching the decomposition of hydrocarbons over a carbon-based catalyst using metal particles to produce carbon fibers; but Applicant does not use metal particles in the carbon-based catalyst. Both Egashira et al. and Chung are cited for teaching that it is known to deposit carbon fibers on carbon particles and that such carbon fibers are useful in electronics and composite materials; there is no suggestion that the carbon fibers are hydrophobic, have an "octopus"-like structure and are used in cleaning up oil spills on water.

The Examiner admits that Murata et al. use a different heating method than Applicant and also that Murata et al. do not collect the deposited carbon materials. Lee, Chung and Egashira et al. are cited for providing an incentive to a person skilled in the art to modify the teachings of Murata et al., by using electric furnace with a heating element made of carbon and silica and the teachings of Chung and Egashira et al. on the making of carbon fibers with a "sea urchin"– shape. In contrast, Applicant forms fibers with an"octopus"-shape, unlike Egashira et al. and fibers that are hydrophobic, unlike Chung.

Further distinctions between Murata et al. in view of Lee, Chung and Egashira et al. are that Murata et al. are silent with regard to the form of the carbon by-product produced, there is no indication that the carbon product is in a filamentous form. In contrast, Applicant emphasizes the production of "octopus"-like carbon filaments, which involves passing electrical current through carbon materials in the presence of hydrocarbons. Lee uses the mixture of a carbonized plant material and a non-organic material (e.g., silica) as a heating element for the electrical furnace. In contrast, Applicant does not use any non-organic material or any other additive. Based on the above information, it would not be obvious to a skilled artisan who is familiar with Murata et al.'s and Lee's patents that passing an electrical current through amorphous carbon such as carbon black in the presence of hydrocarbons could produce filamentous carbon.

A closer examination of the teachings of Chung and Egashira et al. regarding the production of carbon filaments by decomposing hydrocarbons reveals the use of metal- and sulfur additives to carbon catalysts, respectively. This would require a post-treatment of the product to remove metals and sulfur from the carbon product, which would significantly complicate the process. Applicant's invention does not require any additives to carbon catalysts, which is a clear distinction and advantage over the cited art.

Murata et al. produce undescribed carbon particles during external heating of a hydrocarbon decomposition reactor, whereas Applicant produces filamentous carbon particles via internal heating of the reactor by passing electric current through the carbon catalyst. Lee, Chung and Egashira et al. produce carbon products – Lee (porous carbon particles); Chung (filamentous carbon); Egashira et al. ("sea urchin"-shaped carbon particles) using additives to carbon catalysts, such as silica, metal and sulfur, respectively; whereas, no additives to the carbon catalyst are used by Applicant to produce "octopus"-like, hydrophobic, filamentous carbon particles useful in absorbing oil film from the surface of water.

In view of the amendments to claims and arguments presented above, Applicant respectfully requests the withdrawal of the rejection of Claims 39-40 under 35 U.S.C. 103(a) as being unpatentable over Murata et al. (U.S.Pat 5,650,132) in view of Lee (U.S. Pat 4,292,505), Chung (U.S. Pat 5,643,670), and Egashira et al. et al. (*Carbon* 1983).

With regard to the rejection of Claim 40, the Examiner argues on page 6 of the Office Action of May 01, 2006, that "One of ordinary skill in the art would have found it obvious to use carbon black as a catalytic material in a process such as Murata's due to the fact that carbon black is a stable and readily available carbon material." Applicant respectfully disagrees. Even if carbon black was used in Murata et al.'s process, it was not known, or predictable that a

filamentous carbon product having an "octopus"-like structure would be formed. There are a myriad of factors that could play a role in the formation of filamentous carbon particles, such as, passing electrical current through the carbon particles, local heating, the presence of an electrical field; these are factors that are missing from the disclosure and teachings of Murata et al. alone or Murata et al. in view of Lee, Chung and Egashira et al. et al.

Arguably, it might be "obvious to try" carbon black as a catalyst in Murata et al.; however, the Examiner is well aware that "obvious to try" is not the standard for determining inventiveness. See *In re Kaplan*, 789 F.2d at 1580, 229 USPQ at 683 (Fed. Cir.1986). Applicant respectfully requests the withdrawal of the rejection of Claim 40 under 35 U.S.C. 103 (a) as being unpatentable over Murata et al. (U.S.Pat 5,650,132) in view of Lee (U.S. Pat 4,292,505), Chung (U.S. Pat 5,643,670), and Egashira et al. et al. (*Carbon* 1983).

The application and claims are believed to be in condition for allowance in their amended form; allowance of Claims 37-40 is respectfully requested. If the Examiner believes that an interview would be helpful, the Examiner is requested to contact the attorney at the below listed number.

Respectfully submitted,

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